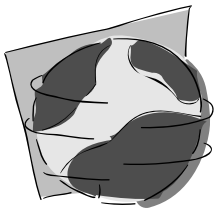
Meet Dr . Elissa Levine and Dr . Jim Washburne



Duplicate and distribute to students.

Dr. Levine: I'm a soil scientist for NASA's Goddard Space Flight Center in Greenbelt, Maryland. Goddard focuses on the Earth and Earth-orbiting satellites. I interpret images from the satellites that tell us about the environment. I also do soil modeling. We put all the soil information into a computer. We then factor in things like the type of vegetation and climate and write equations to describe how water moves through soil or how soils change over time. We try to predict what will happen.

Dr. Washburne: I'm a hydrologist at the University of Arizona. A hydrologist studies water. I'm studying the flows of water from one part of the planet to another. GLOBE fits into my work with NASA's Earth Observing System (EOS). Its goal is to launch the next generation of environmental resource satellites to collect data about the Earth. But as good as these satellites are, soil moisture is difficult to measure from space. There are really no good databases for regional or global soil moisture to check the satellite data.

GLOBE: *Soil is just dirt. Why is it important?*

Dr. Levine: My favorite question. Soils are one of the most important natural resources that we have. Every part of the ecosystem depends critically on soils. Soils filter water and remove its impurities. The food we eat, the clothes we wear, and many building materials all grow from the soil and depend on its conditions. Water and heat flow through it. It allows nutrients to be stored. Since the soil affects the entire ecosystem, I call it the great integrator.

Dr. Washburne: Soil moisture – the amount of water contained in the soil – is an important factor in determining the kinds of crops, lawns, shrubs and flowers we can grow. Scientists would like to know how soil moisture interacts with the atmosphere and climate.

GLOBE: *What questions are you trying to answer with the GLOBE data?*

Dr. Levine: What kinds of soils are there around the Earth? What are their properties? How do they relate to the other parts of the ecosystem?

GLOBE: *What kind of data do you want from GLOBE students?*

Dr. Levine: Students will examine samples of soil from their study site and study them in a variety of ways. I want them to become familiar with soil properties so we'll better understand how moisture flows in soil, how soil relates to vegetation, how it affects the climate, and so on. I'll put their data into my models.

Dr. Washburne: Students will learn how soil moisture varies by season throughout the world. To do

that, we need as many observations as possible to compare with the satellite data and our computer models. Satellites, at best, can only measure soil moisture in the top five centimeters. We will use the student data to verify what the satellites measure with what's actually on the ground.

GLOBE: *Why do you need students to collect this data? Why can't you just get scientists to gather it?*

Dr. Levine: There aren't enough scientists. There are many different kinds of soil on the Earth. Most research has been in agricultural areas. But there are urban areas, forested areas, arid areas and many other places for which we have little data.

Dr. Washburne: When scientists do a careful study of soil moisture somewhere, that is only one measurement at one site at one time. GLOBE students represent a vast network of soil moisture and related observations that eclipses any past effort.

GLOBE: *Have students collected data before for soil investigations?*

Dr. Levine: Not at this level. Most work has been done by individual scientists, never by this great worldwide sampling effort.

Dr. Washburne: I'm confident students can do it. The soil-moisture observation is simple. You dig up some soil, weigh it, dry it, then weigh it again. The difference is how much water has been dried out of the soil.

GLOBE: *You are both involved with NASA, yet the common perception is that NASA explores space. Is it also involved in Earth exploration?*

Dr. Levine: Yes. NASA looks at Earth as a planet, just like any other planet. NASA's Mission to Planet Earth is one of its most important projects. Only by observing the Earth from space can you monitor its many ecosystems and study the interconnections between them.

GLOBE: *Tell us a little about yourselves. Where did you grow up and go to school?*

Dr. Levine: Long Island, in the suburbs of New York City. My parents used to take me to parks, caves and petrified forests in upstate New York, and I became interested in natural areas. I always had this fantasy to live in a cave or under a waterfall. That was the beginning. I liked math and science in school. In college in the early '70s, I studied psychology for a couple of years, but I got a strong idealistic desire to preserve nature and help feed people. So I went to an agricultural school where I became interested in soils. In the summers, I did soil mapping and conservation work. When I finished school there, I went for my Masters' and Ph.D. degrees. This is where I really began to explore soil profiles in different parts of the US and the world. I was fascinated by how each soil develops its own unique properties that determine how it can be used. As I learned more about soil properties and

soil formation, I began to put it all together in mathematical models.

GLOBE: *We don't see enough women in science.*

Dr. Levine: I'm glad that you brought that up. In high school, I was interested in science. But I didn't really trust that I could do it.

GLOBE: *Because you were a woman?*

Dr. Levine: That's what I think. Most people around me are men, and my experience has shown that there is generally a difference in the way we think. I tend to see the big picture, while many men around me tend to focus better on the details. So together we complement each other. But we need more women in science because it's unbalanced now. We need to tie all these systems together.

GLOBE: *Were you discriminated against because you're a woman?*

Dr. Levine: In high school, I got As and Bs in science and math, but I didn't have much guidance from the people around me, or many role models to help me. I wanted to have a good career, but to also have a family. I learned that if I followed my heart, things will work out. I am now a scientist and I have two wonderful children. People in science who have families add a very positive dimension. A family gives you purpose. I'm concerned about the Earth because I want my children to have happy and healthy lives. You can have both a family and career.

GLOBE: *Are there many women in the field now?*

Dr. Levine: Yes, and more are entering the field. There is an organization called the Association of Women in Soil Science, and women get together at international soil-science meetings. We tend to have similar experiences.

GLOBE: *Where did you grow up, Dr. Washburne?*

Dr. Washburne: I was born in Denver, Colorado, and stayed in the state through high school. I spent a lot of time in the Colorado Rockies hiking and working on ranches. Like many states in the western U.S., Colorado is semi-arid and you usually have to irrigate crops or water lawns. So water's been an element in my life for a long time. My goal in college was to major in physics, but since I grew up in the Rocky Mountains, with their abundant outcroppings as testament to the great forces of nature, I was drawn into a geology major as well. In graduate school, I studied geophysics at Colorado School of Mines in Golden, Colorado. I learned to use electrical measurements to remotely sense below the surface of the Earth for mineral and oil deposits. After several good years, the exploration industry declined and I was laid off, I returned to school to get a Ph.D. in the exciting and interdisciplinary field of hydrology.

GLOBE: *When did you first become interested in science and why?*

Dr. Washburne: The methodology of science, of carefully studying something, is very satisfying to me. I have always enjoyed science and unraveling the relationships between the things around me, but it was not until I took my first physics class that I fully appreciated the simplicity and power science has to explain our universe. You will find that becoming a scientist requires a strong commitment. I find science satisfying because it helps to explain nature and is challenging - like an unfinished mystery.

GLOBE: *If there was one question that you could answer in your field, what would it be?*

Dr. Levine: Soils have different layers, colors, shapes and textures – all kinds of different things and different organisms living in them. How do they all fit together in this complex system?

Dr. Washburne: What will be our effect on the climate over the next hundred years? If the climate warms up, the hydrologic cycle might become more active, but we really do not have all the answers yet.

GLOBE: *What are the rewards of science?*

Dr. Washburne: I find all Earth science, particularly hydrology, to be very satisfying and valuable to society. What attracts many of us to science is not necessarily the global discoveries as much as the day-to-day discoveries, revelations, and satisfaction that the search and the sharing of what we know brings to us.

I'm also gratified that there are important social and policy issues that hinge on my work. My satisfaction comes from understanding something clearly, and it is amplified when you know this something has great ramifications. For instance, my study of soil moisture is part of a larger effort to improve the climate models scientists use to understand human impact on global temperature. The social and economic ramifications are enormous.

But everyday satisfactions are important, too. Knowing why the old farm road gets so slippery when moisture gets mixed in with the clay or understanding where the colors of the rainbow come from can be richly rewarding to you or me. Science is a process with many exciting (re)discoveries along the way that are new and meaningful to the individual. Don't forget to savor the small discoveries. They are as much the glue of the universe – the spice of life – as are all the grand old theories.

GLOBE: *Scientists all seem to have a healthy dose of curiosity. Is that something you identify with?*

Dr. Washburne: Definitely. It's important for scientists to ask questions. Scientists are no different from anyone else. I don't think

there's anyone who can't become a scientist by applying themselves. In school, we are deluged with facts. From those facts, try to understand the fundamentals and apply them to issues that matter to you.

Despite all we do know, there's so much more to learn about the world and the way its elements interact. I think GLOBE students are lucky because they will be the ones to harvest the results of NASA's Mission to Planet Earth throughout their careers. It's very exciting that there's still so much to learn and understand about the world around us.

Dr. Levine: I know that I have a strong dose of curiosity. This curiosity is probably why scientists say: the more you learn, the more you know how little you know. I am especially curious about what new information about soils we are going to learn from the GLOBE student data.

GLOBE: *Do you have international colleagues?*

Dr. Levine: I do. Recently I was at a conference in China to study similar issues about soils that we're also studying in the U.S. I have also worked with people in Australia, Europe, Russia, South America and the deserts in Africa.

Dr. Washburne: I have colleagues in Europe and Latin America and have traveled to some far corners of the world. I am looking for collaborators from all over the world to work with GLOBE students and their observations.

GLOBE: *When you were growing up, did you have heroes?*

Dr. Washburne: I always wished I had grown up in Lewis and Clark's time or had been with Captain Cook in his voyage around the world. Even the simple mountain men were heroes to me. How exciting it would be to be among the first to explore previously uncharted territory, where every step you took would be a discovery unto itself.

GLOBE: *What's a typical day like for you? Do you work in labs?*

Dr. Levine: Although I am interested in field soils, much of my time is spent in front of a computer doing research, running models, writing and reading scientific articles, and answering email. When I do get to go in to the field, I go with a team of other scientists and we spend a week or two characterizing and monitoring different sites based on soils, vegetation, and climate. Then we bring samples back which are sent off to be analyzed. I use the data from the field work to test and create the models I use for my research.

Dr. Washburne: Surprisingly, I spend the majority of my time writing and reading about 40% and 10%, respectively during the average week. The 30% of my time I spend on the computer is divided between email, analysis, and programming. I would like to spend more time reading about what other

people have done. That's important for scientists to do, and sometimes I only have time to skim abstracts. I spend ten percent of my day in meetings, talking with other scientists and devising strategies for various problems. If I get through a week when only 10% of my time is unclassified, then I am doing exceptionally well. What I like about my job is that every day is different.

GLOBE: *You said that students have not done this kind of work before. Is GLOBE unique?*

Dr. Levine: Oh, definitely. It's going to help us so much to understand soil properties. Having soils in grade school is great. It will help all people have a better

appreciation of the importance of soils. I'm excited that soils will be an important part of their Earth systems studies. It should have been there all the time.

GLOBE: *What do you hope students will learn in GLOBE?*

Dr. Washburne: I hope they will better observe and understand the environment around them and appreciate the need to support scientific research – particularly to learn how people and nature can live in greater harmony.

GLOBE: *Why should a student enter soil science today?*

Dr. Levine: Soils are critical for survival. We need young scientists who understand how soils fit into the rest of the ecosystem and help us maintain our standard of living and have a healthy Earth to live on.

GLOBE: *Why should a student today become a hydrologist?*

Dr. Washburne: Hydrology is exciting and has many specializations. A very important one is investigating and cleaning up our ground water. This will take a lot of work. The global hydrology I'm working on is also important. NASA's launch of a new generation of Earth resources satellites will definitely generate many questions to be solved by today's students for years to come.

GLOBE: *Any advice for students in general and young women in particular who might be interested in pursuing Earth science?*

Dr. Levine: My number one advice for all students is to go outside and explore natural areas that are nearby. Look at flowers, look at the ground, feel the soil under their feet, dig a hole, and look at what's there. Once students appreciate the ecosystem, a lot of their other classes in math

and science, even history and language will make more sense. So that's number one: Get outside.

To women I would say, we need you. We need to take our place next to men. We have a very important role to play. Both men and women need to look at the Earth through a more holistic, nurturing type of approach. Women can do anything they choose to and do it really well.

Dr. Washburne: It is important not to be narrowly focused. I urge students to get a broad background in whatever they're doing. In global hydrology, it's essential to understand soils, remote sensing, the atmosphere, meteorology, and how trees and plants interact with water. It's very interdisciplinary. Computers are important, and mathematics is the foundation for a lot of our work. Do what you enjoy doing the most, and don't feel that all the questions have been answered or are going to be answered anytime soon. Speak up and ask questions, because fundamentally that's what we do: ask questions and look for their answers.